Potential field data and 3D modelling

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Geological Survey of Norway (NGU)

TopoScandiaDeep kick-off meeting

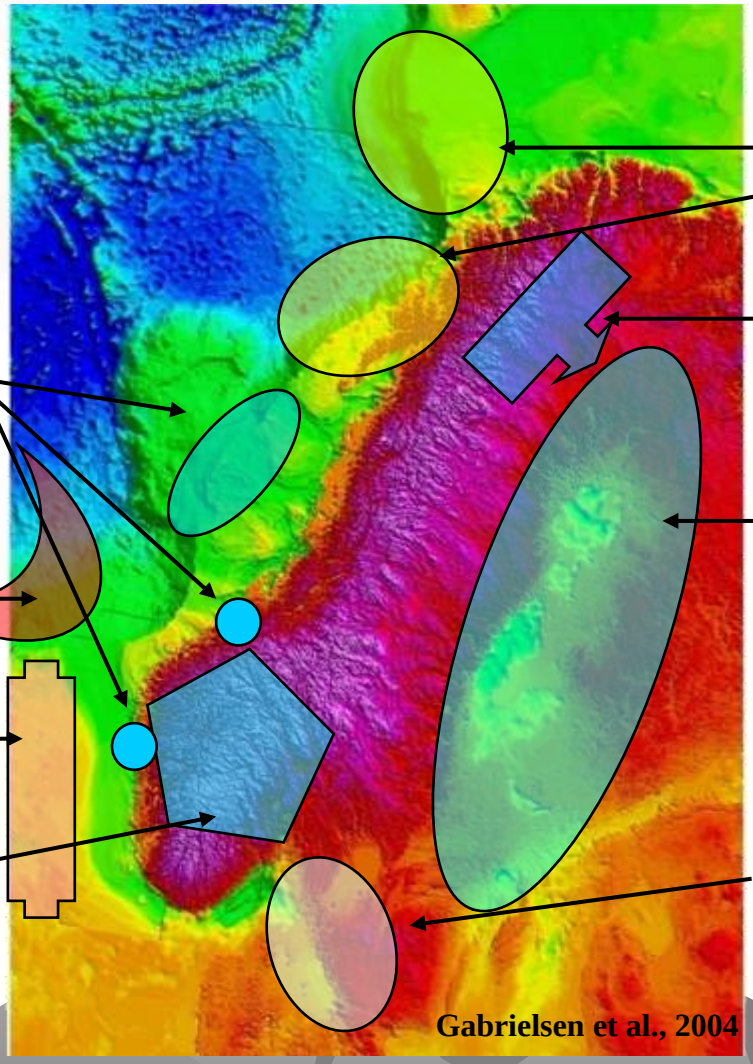
Haraldvangen – 21-22 January 2009.

NGU
Norges geologiske undersøkelse
Geological Survey of Norway

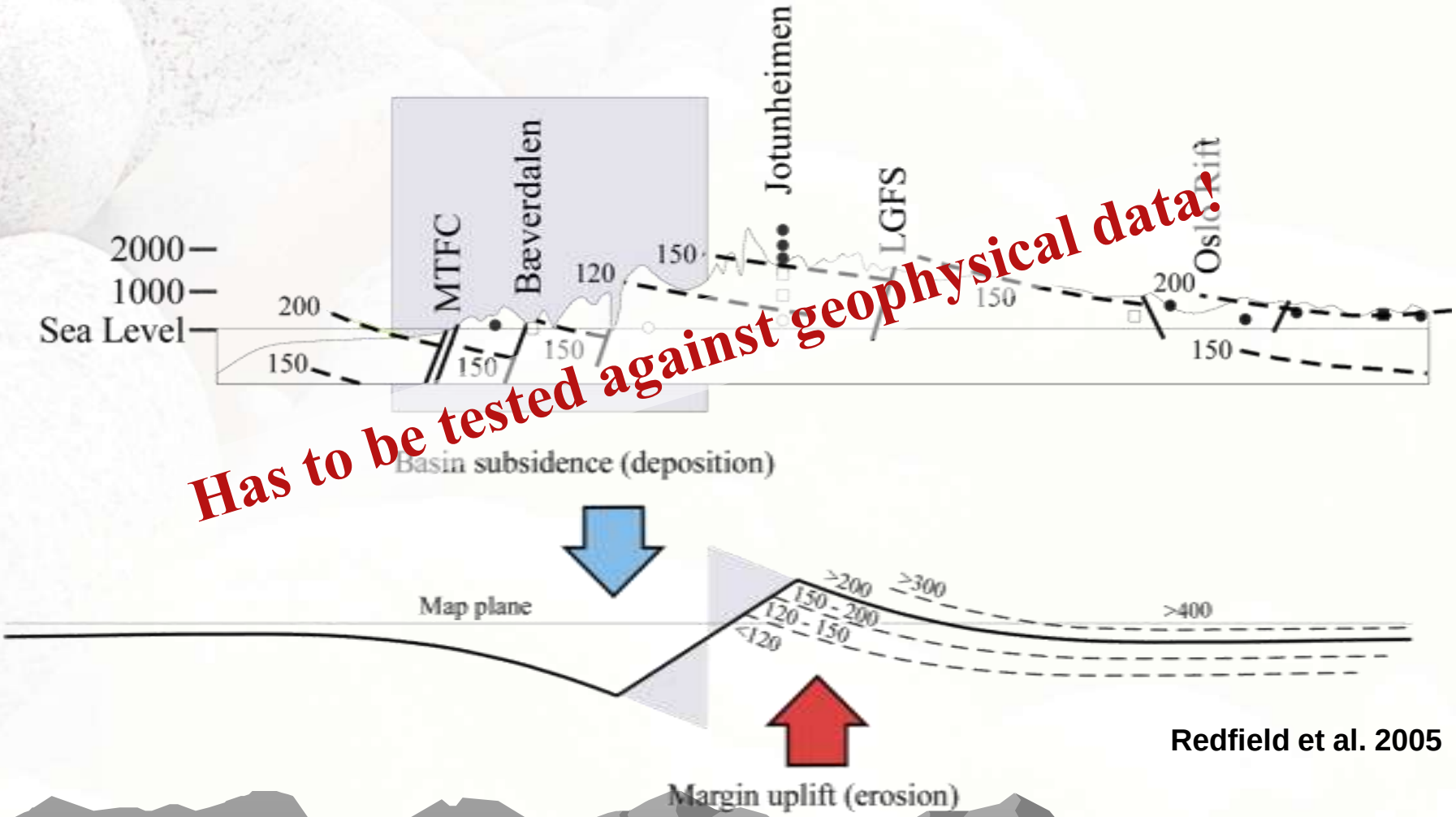
Origin of mountains: uplift

Remnants of Caledonian orogeny

+…..



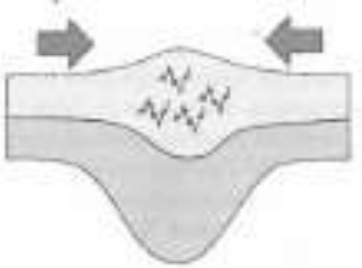
Flexure
Rift shoulder concept

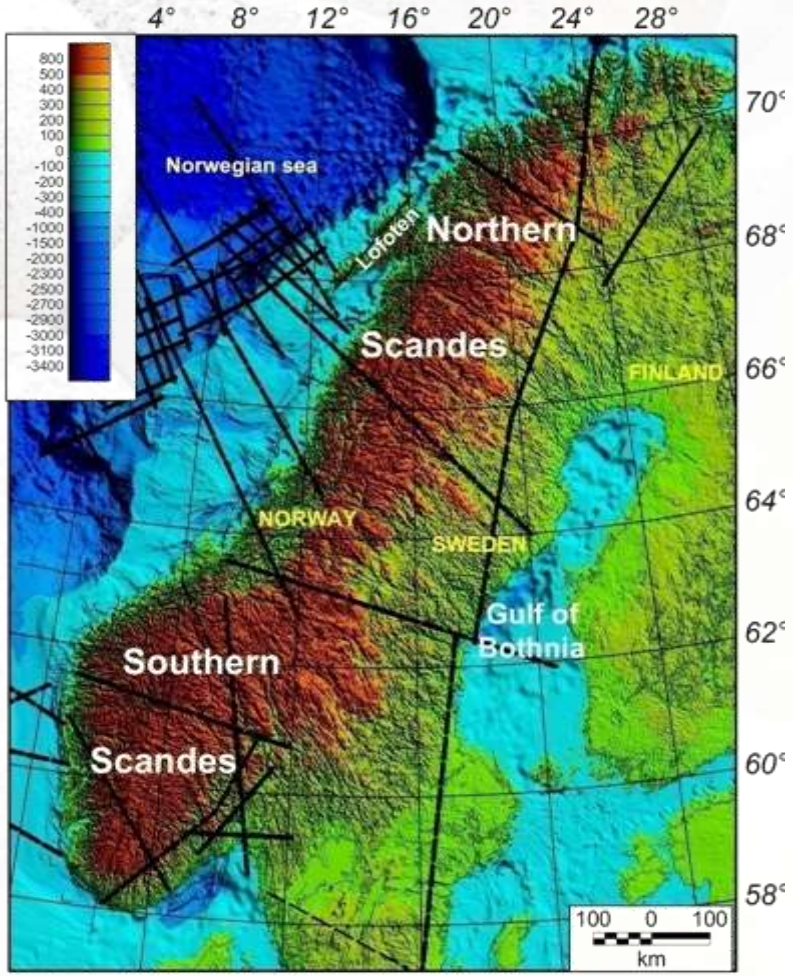


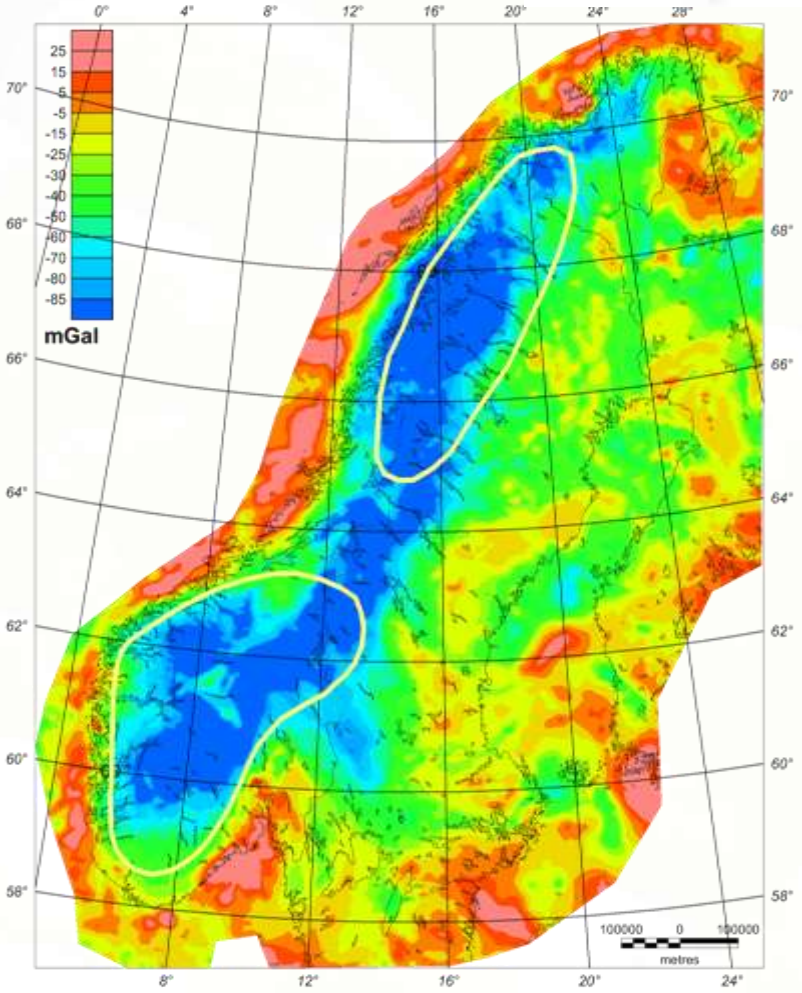
Has to be tested against geophysical data!

Redfield et al. 2005

Topography and gravity

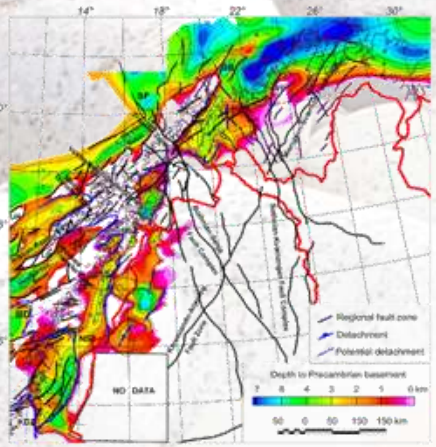




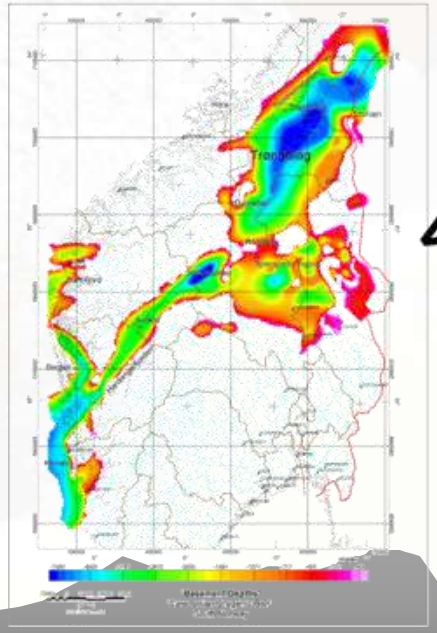


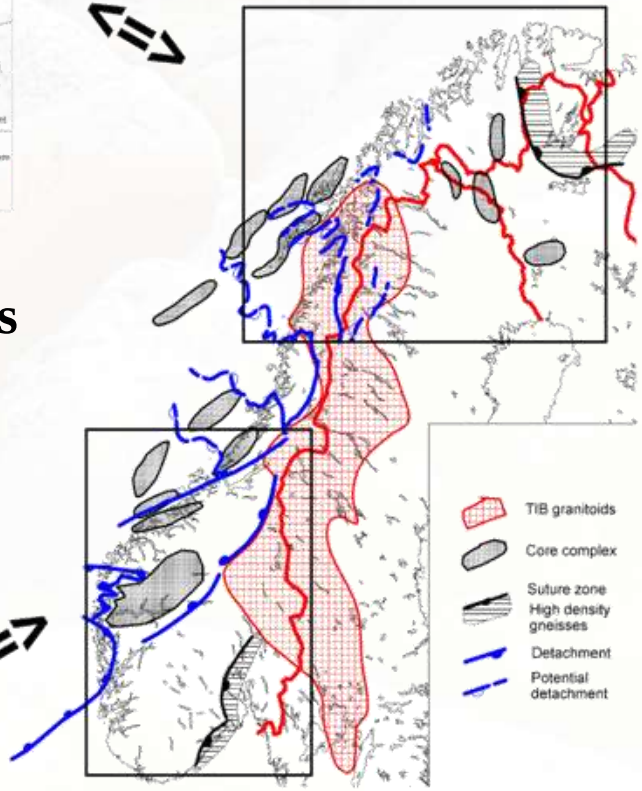
Topography/bathymetry compilation:
Dehls et al. 2000

Gravity map as compiled by:
Skilbrei et al. (2000), Korhonen et al. (2002)

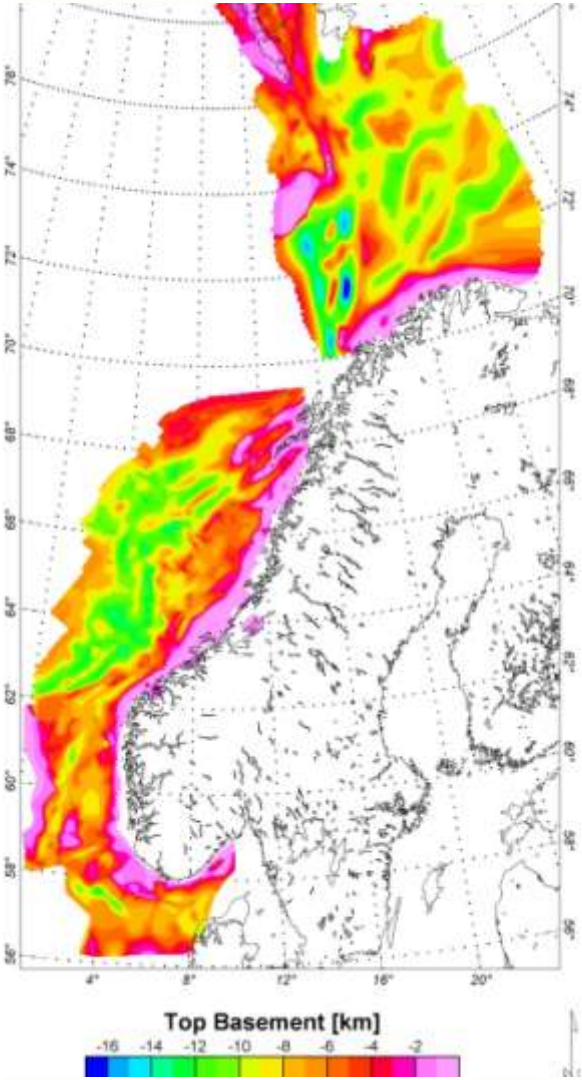


Basement thickness

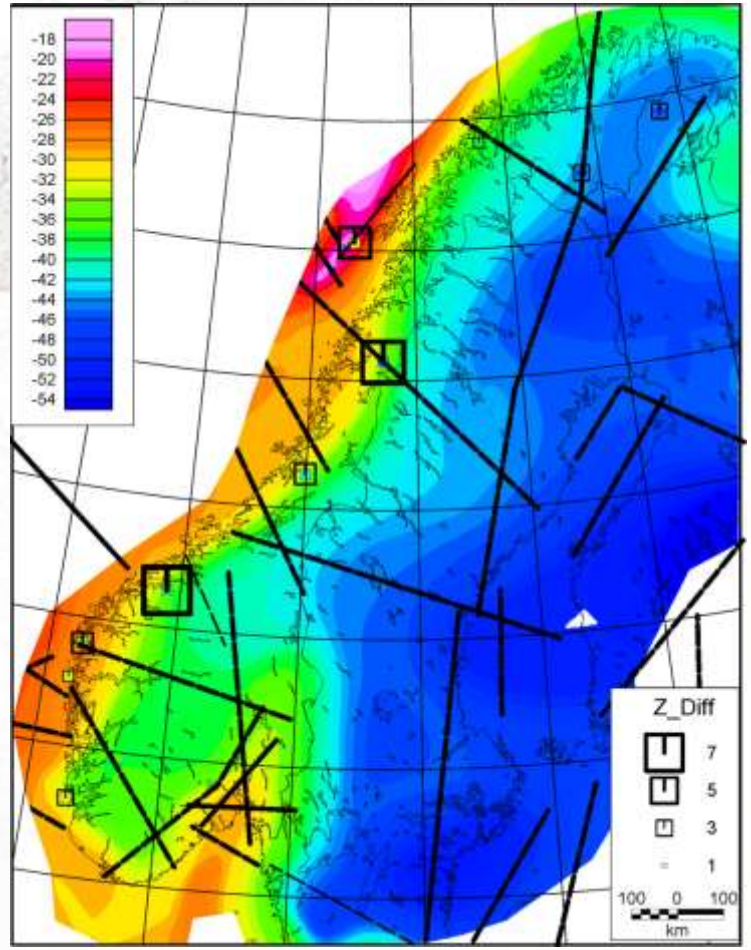




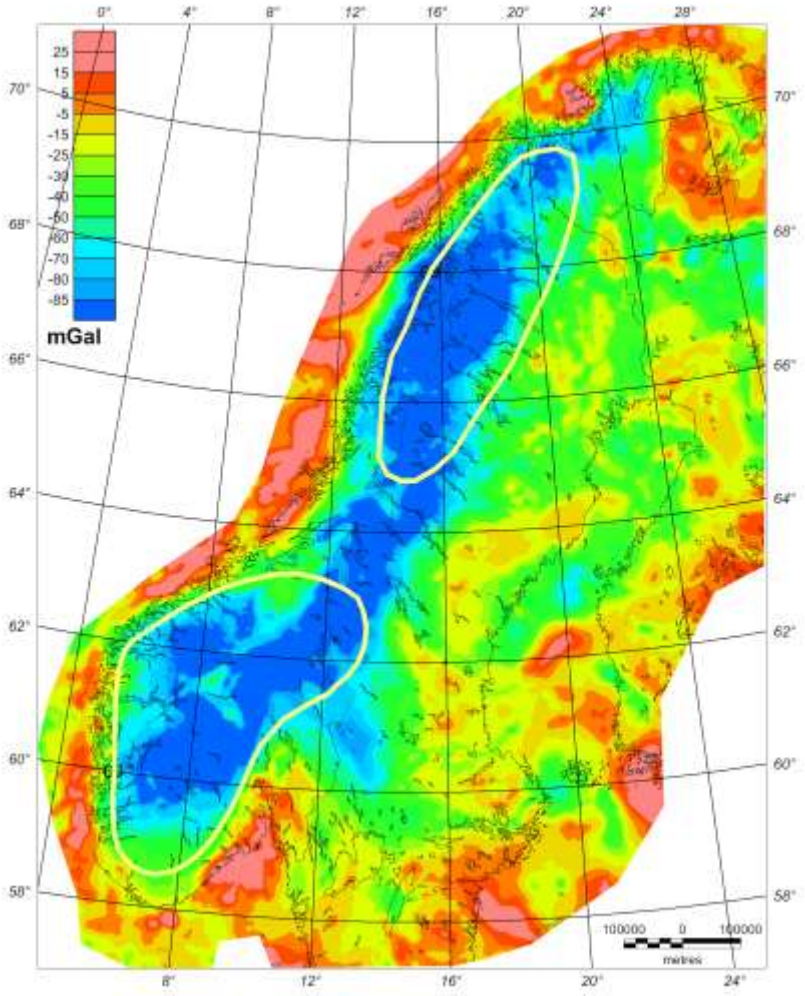
Basement units



Seismic and gravity studies



Seismic Moho depth after Kinck et al. 1993, Mjelde et al. 1998, Olesen et al. 2002



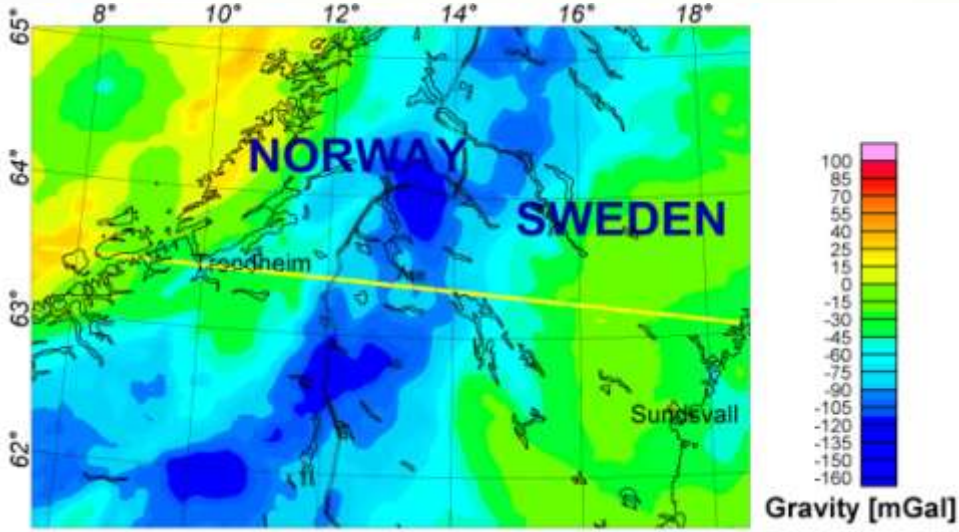
Gravity map as compiled by: Skilbrei et al. (2000), Korhonen et al. (2002)

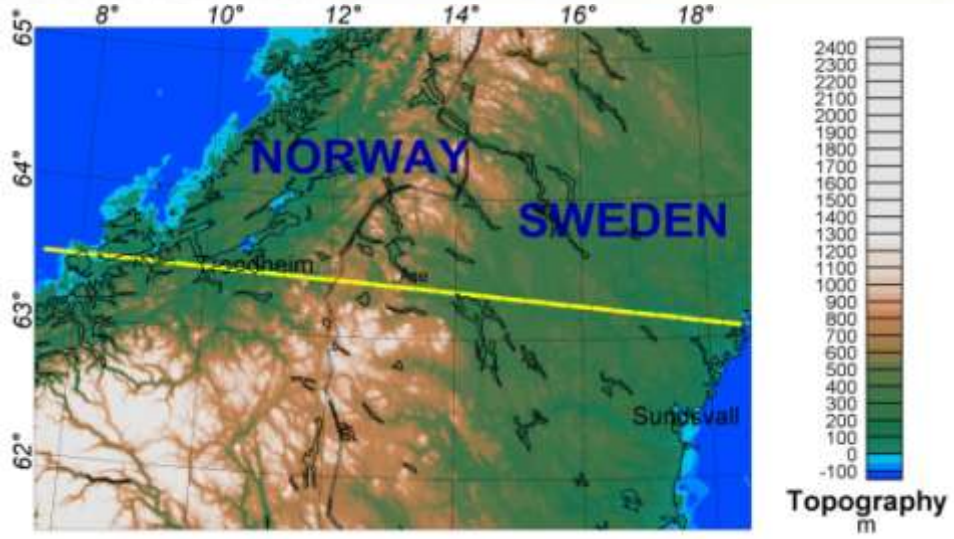
Integration of data

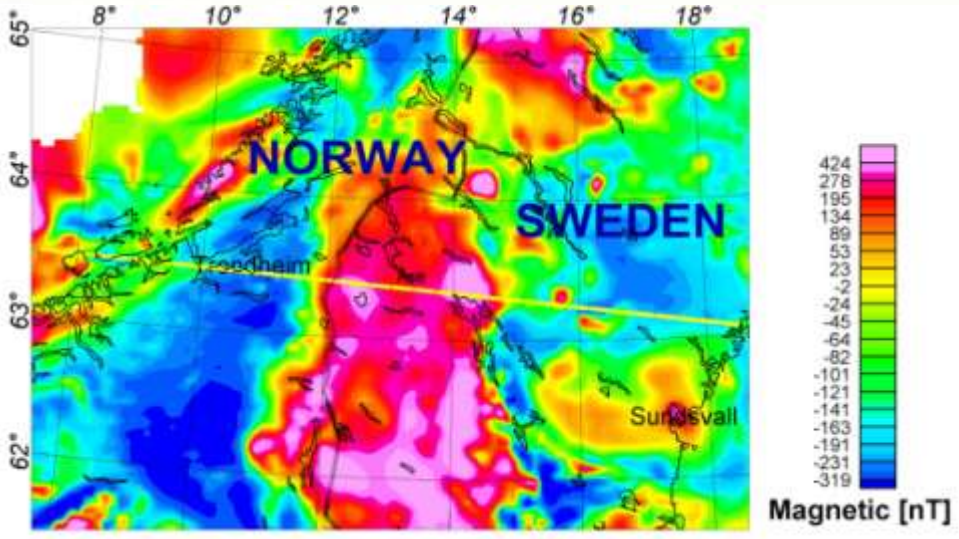
Profile is crossing the Central Scandes and the TIB granitoids

Reflection seismic data available from Schmidt (2000)

Receiver functions from SCANLIPS

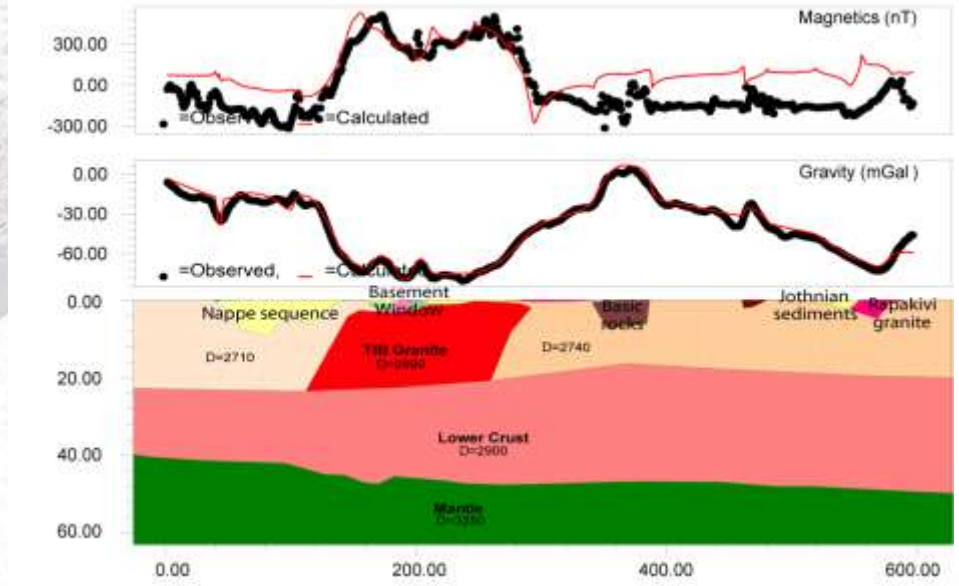




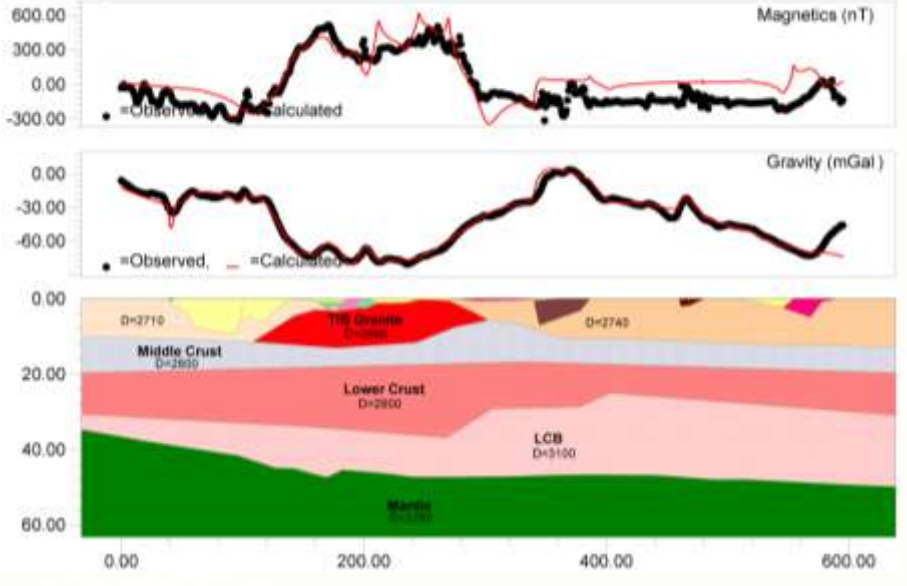


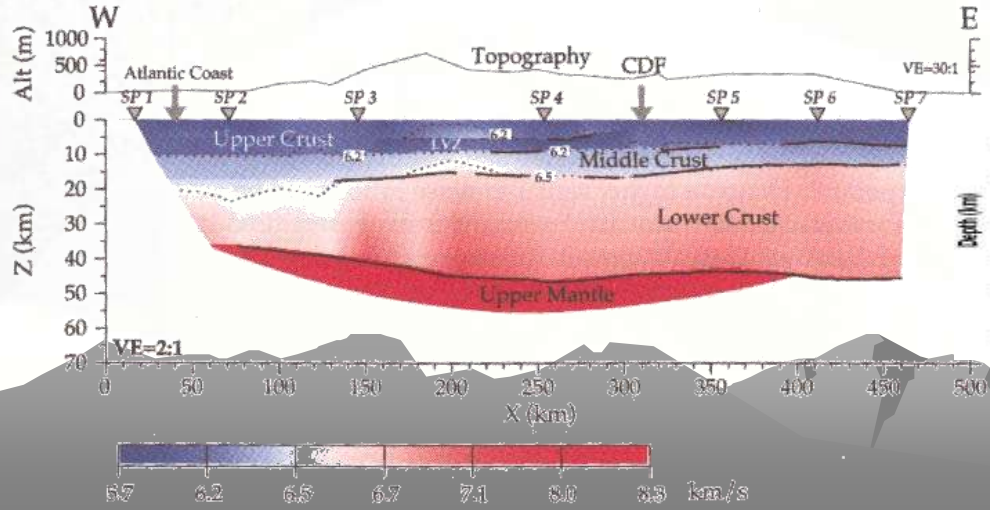
2 alternative models for the CABLES line

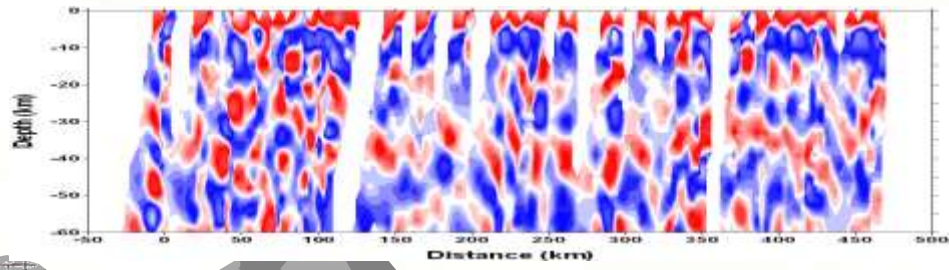
Model A



Model B

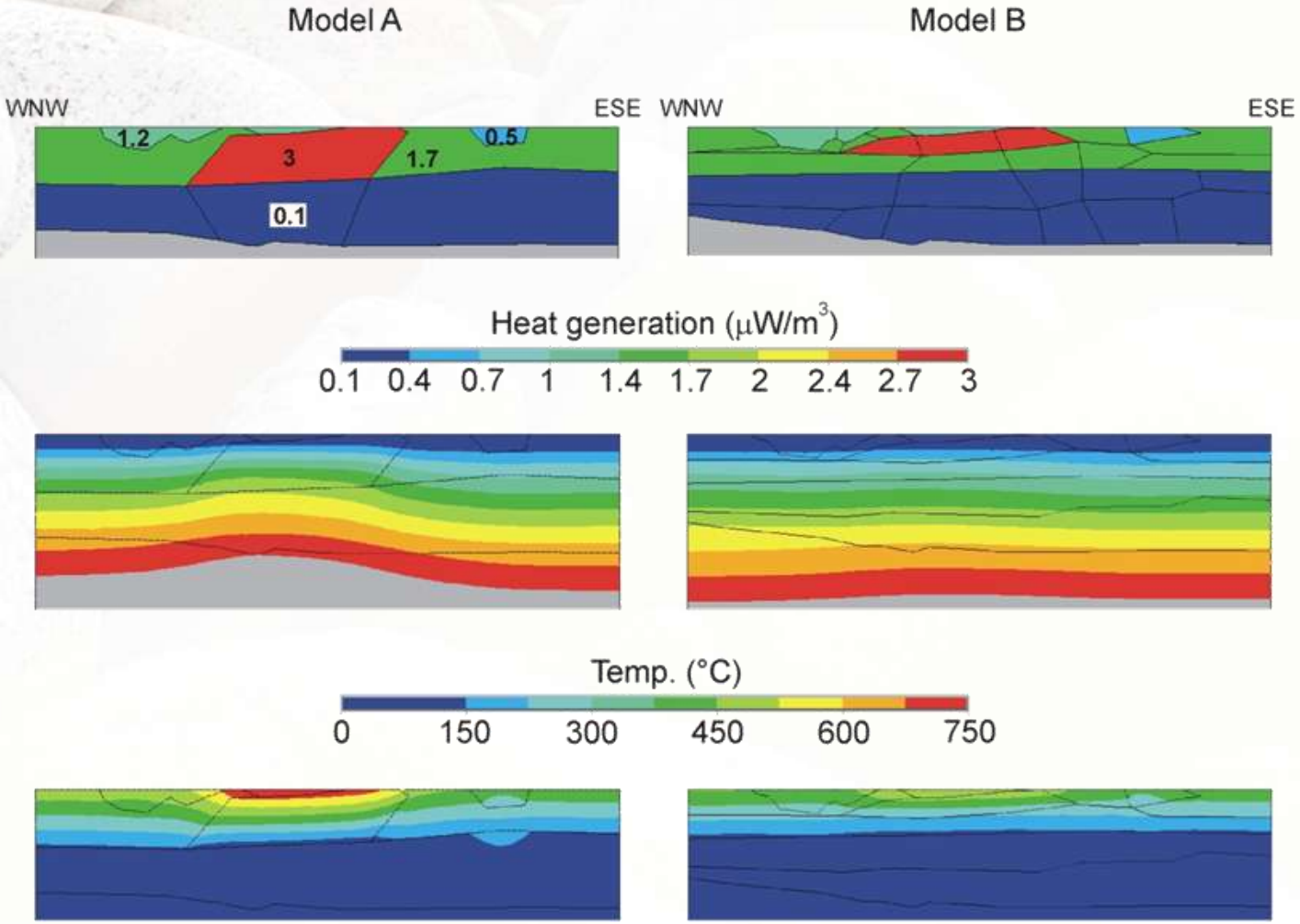






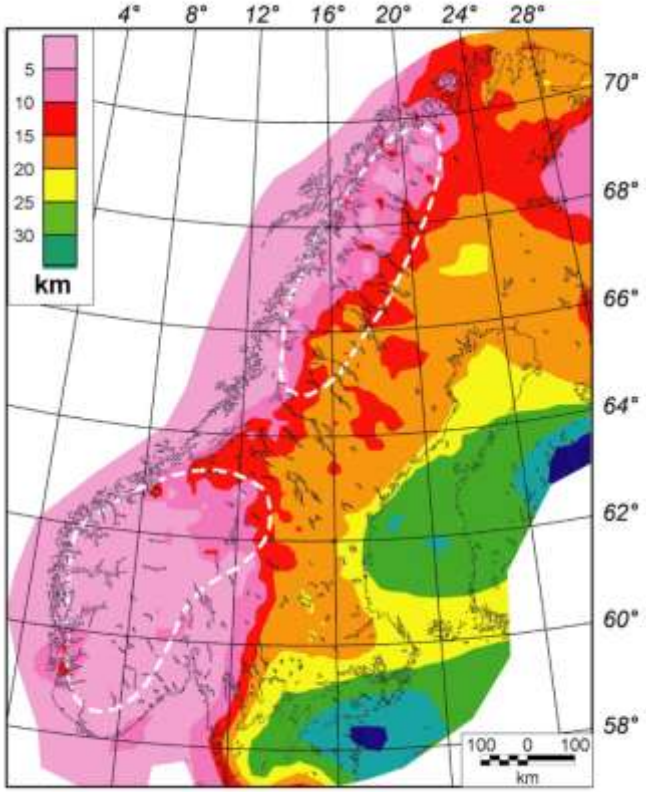
Schmidt 2000

Implications of crustal structure for temperature field

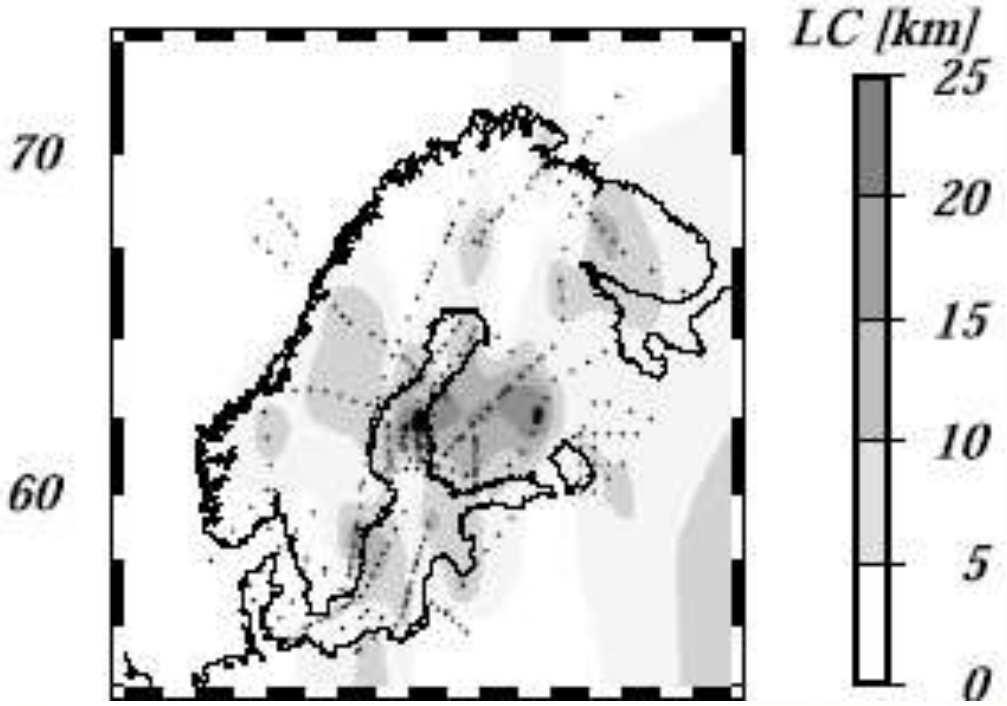


Pascal et al., 2007

3D modelling

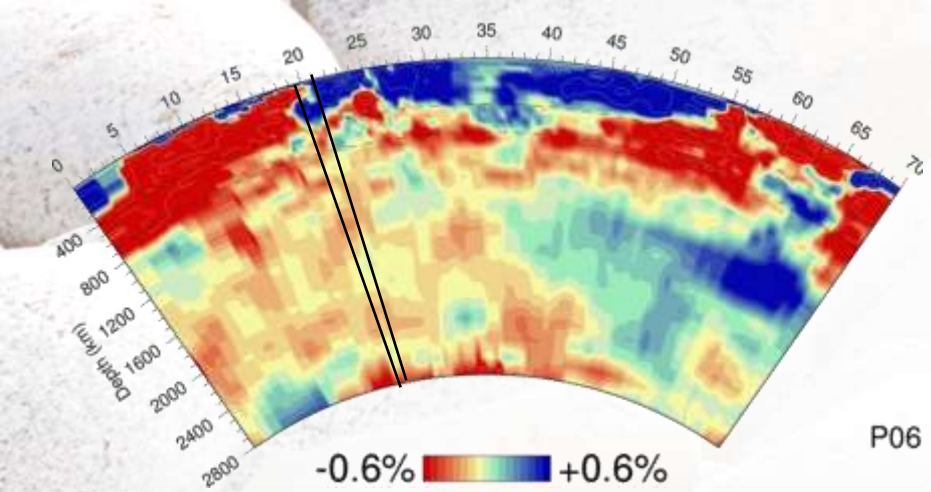


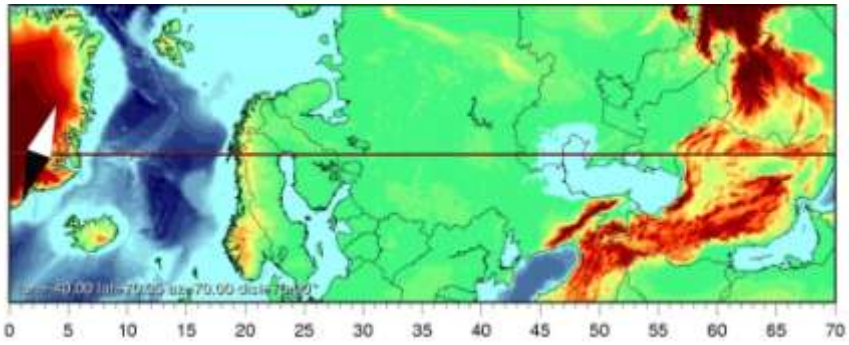
Isostatic high-density lower crust

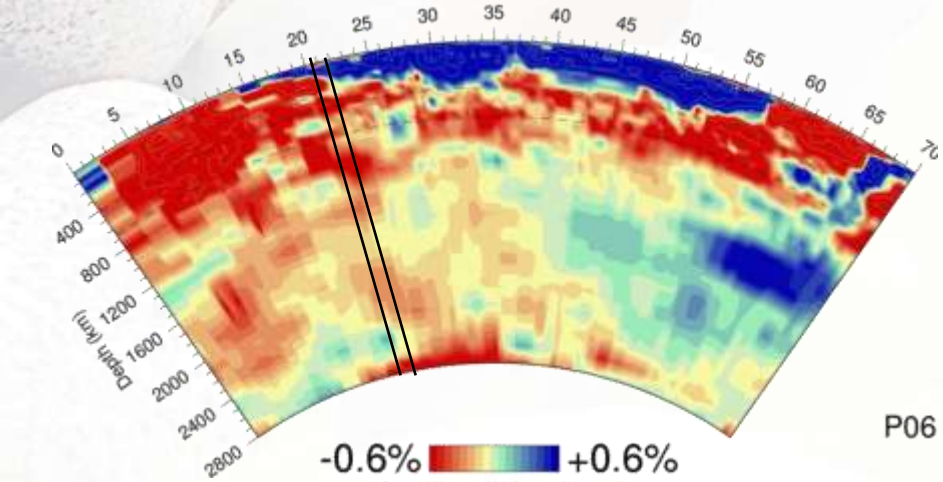


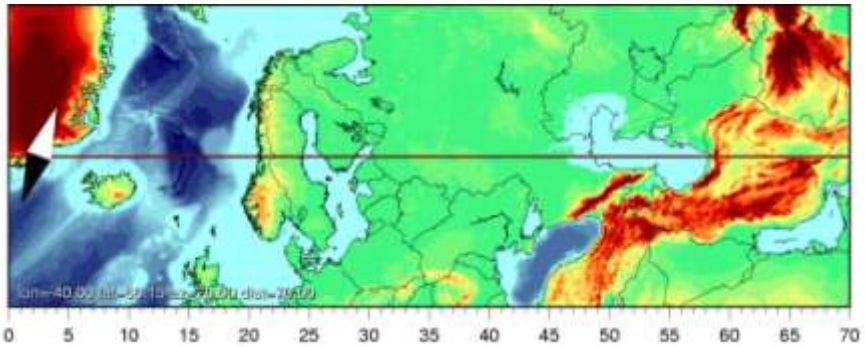
Seismic high-velocity lower crust
(Perez-Gussinye et al. 2004)

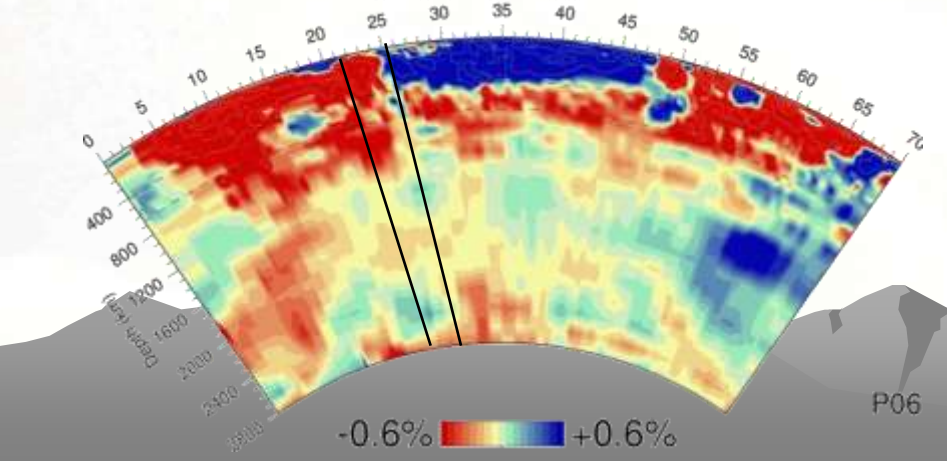
Wim Spakman 2008

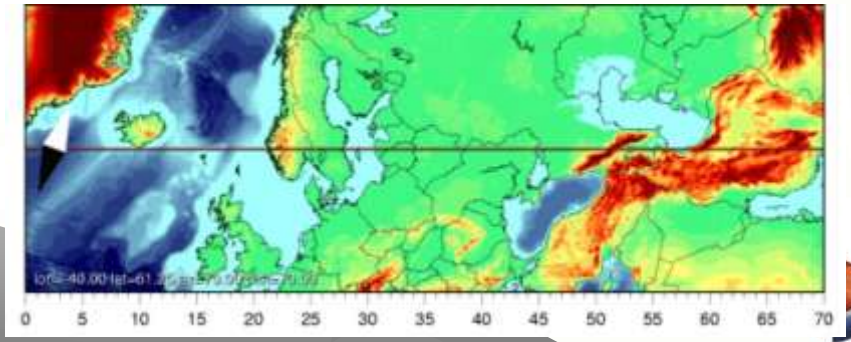




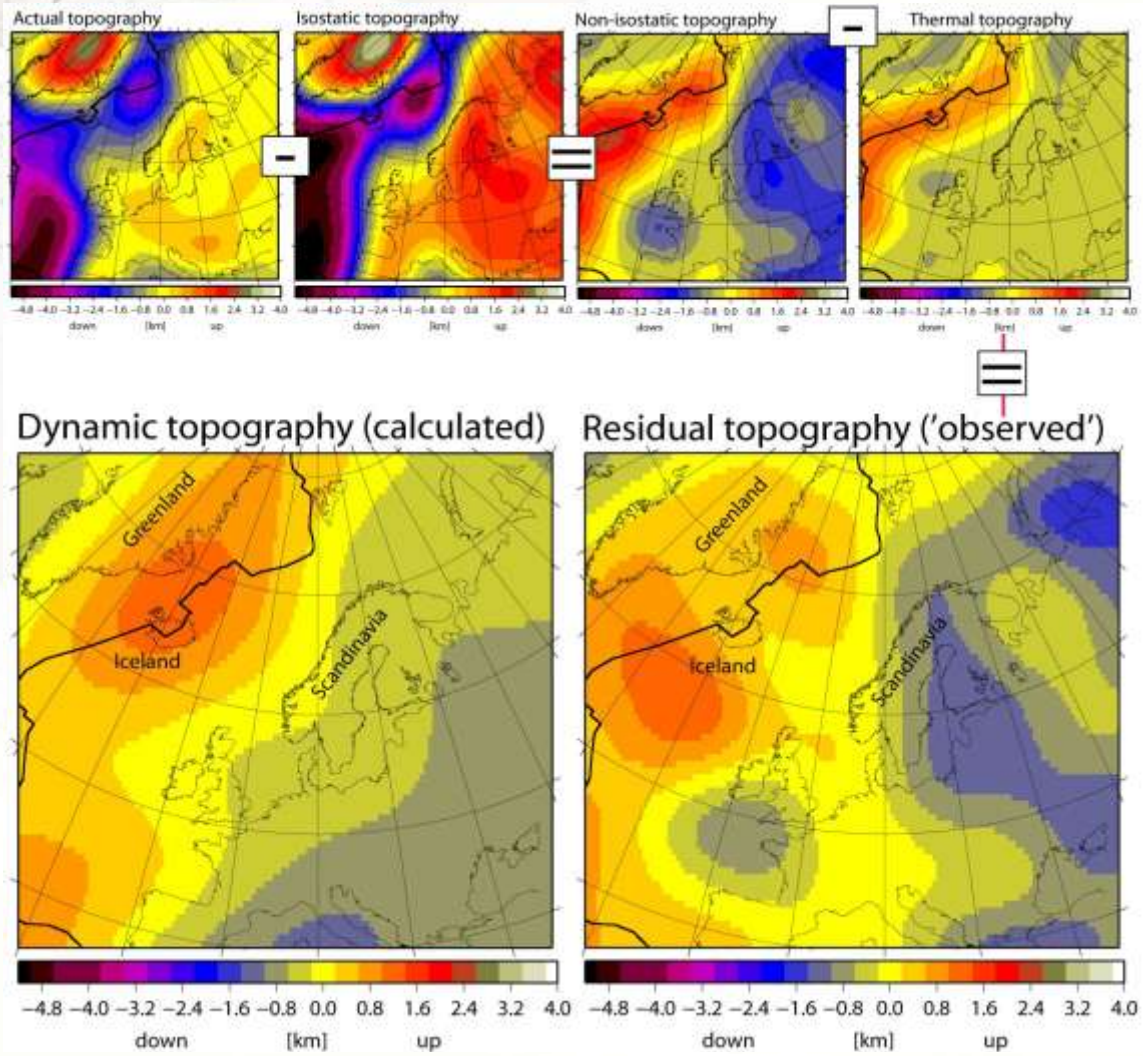








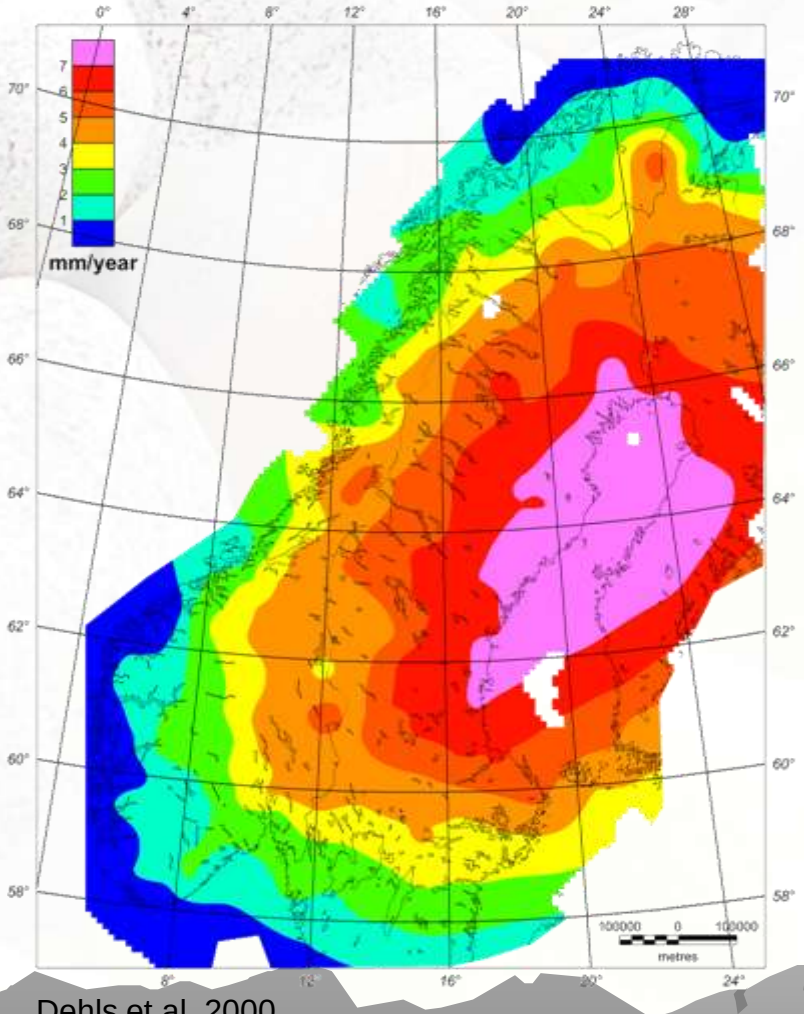
3D modelling in space and time



Steinberger et al. 2008

Present uplift

Vertical (present uplift)



Dehls et al. 2000

Present uplift component (>1 mm/yr) not explained by glacial isostasy after Fjeldskaar et al. 2000

Vermeersen & Schottmann 2008

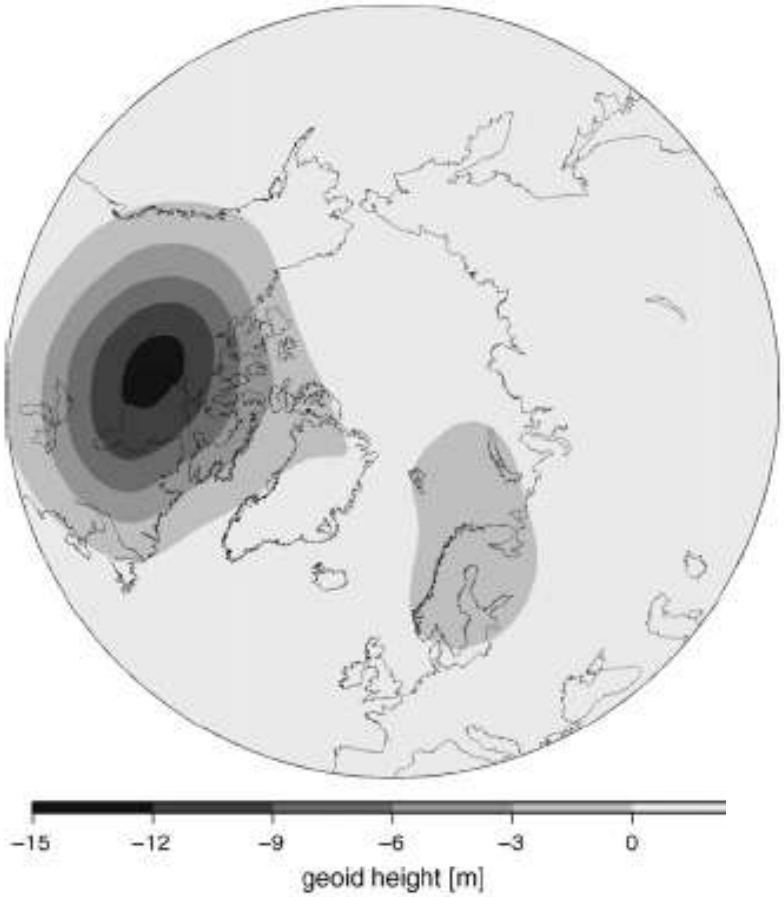
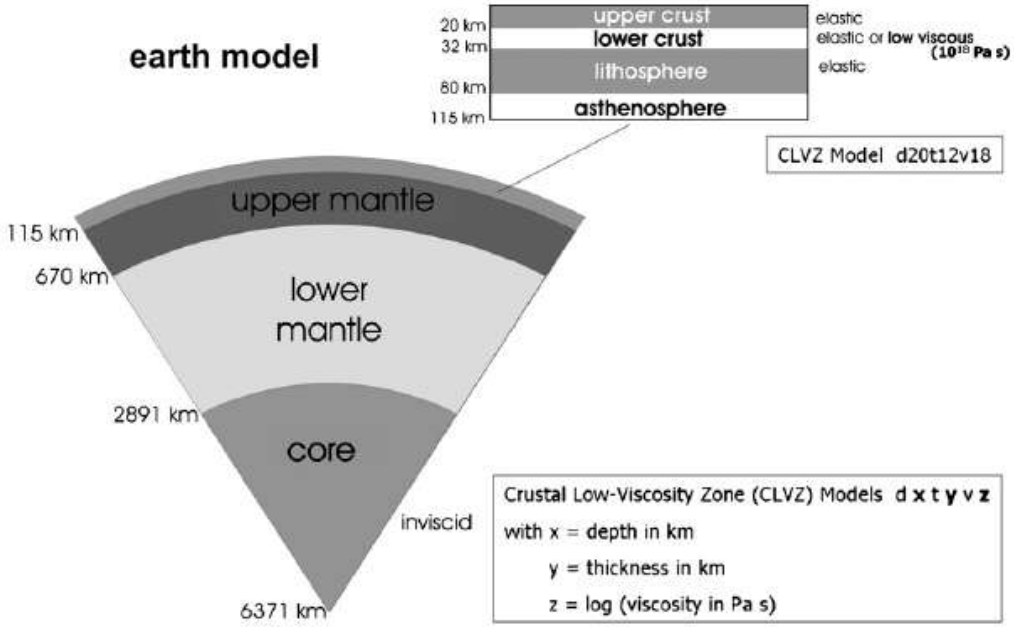
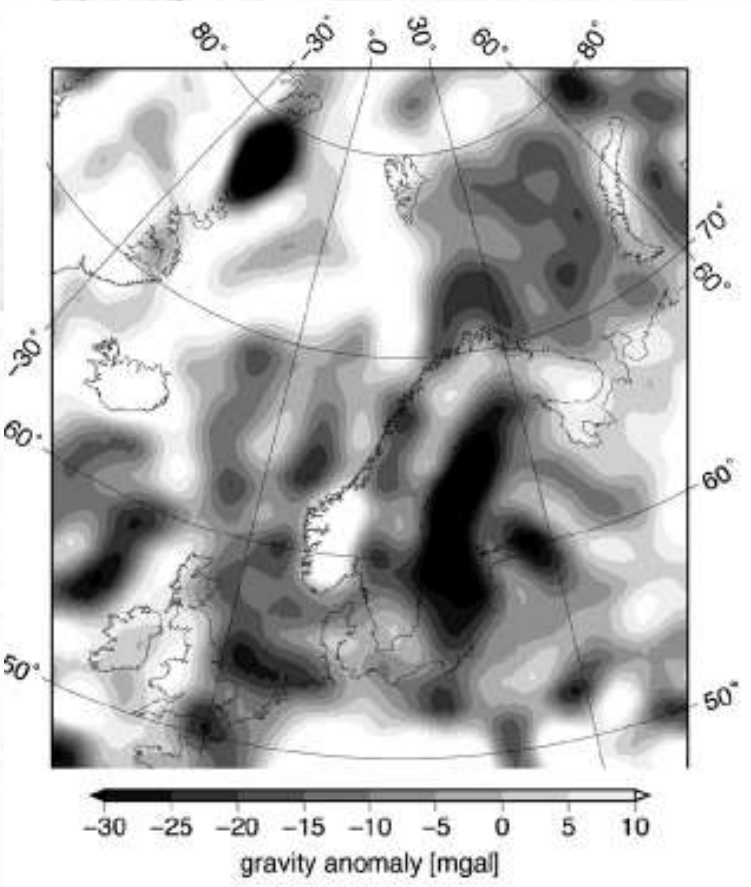
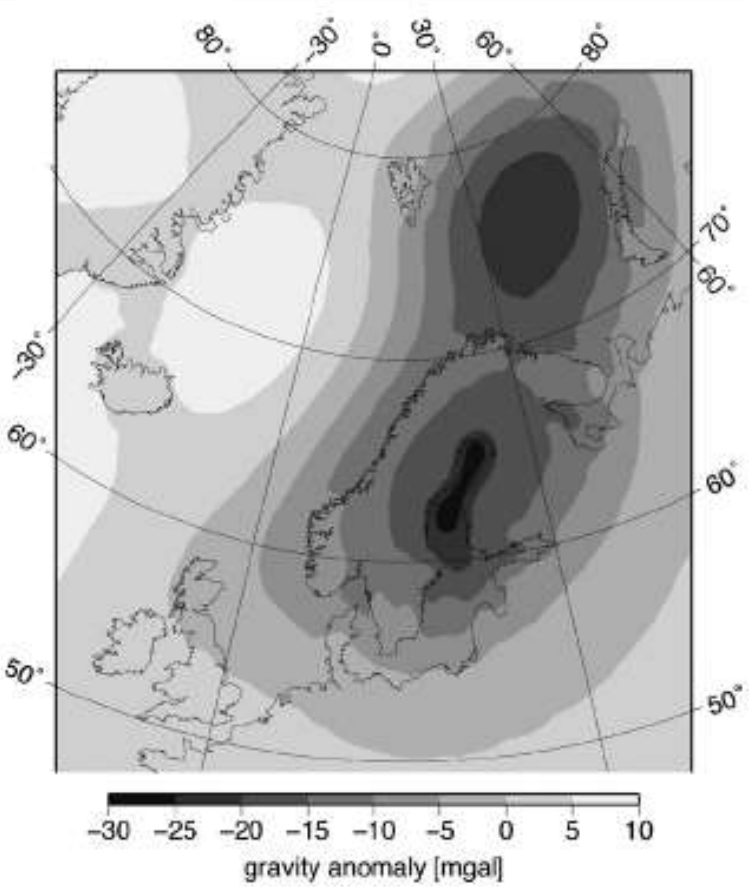


Fig. 6. Total GIA-induced geoid height remaining at present.



Gravity effect of glacial isostatic adustment (GIA)



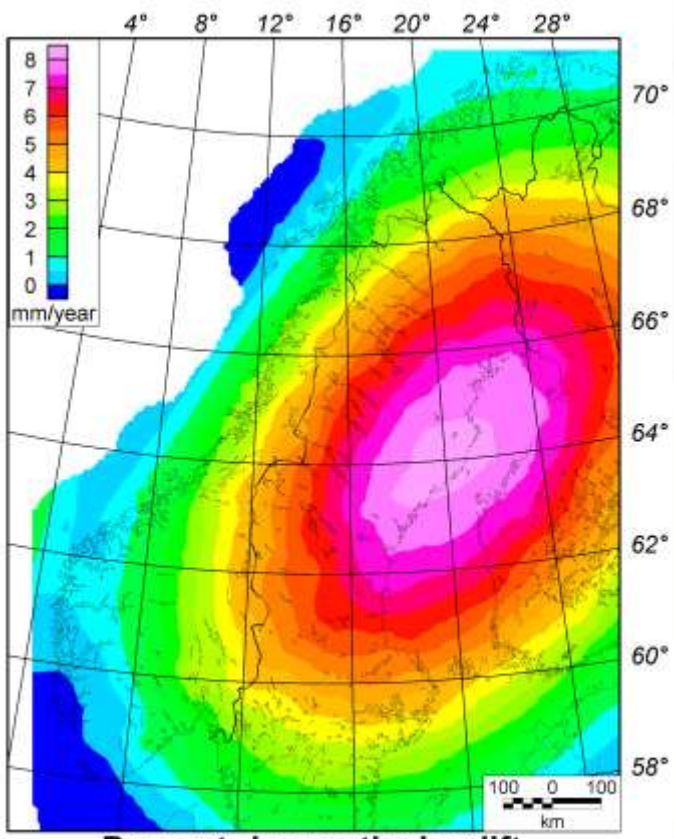


Observed free-air gravity

GIA gravity

Vermeersen & Schottmann 2008

New models for uplift and geoid



Present-day vertical uplift
Lidberg et al. 2006

EGM 2008
Complete to spherical harmonic degree and order 2159, and contains coefficients extending to degree 2190 and order 2159

Summary

3D lithospheric model will be established

GIA models can be coupled with 3D lithospheric models

Tomography model allow to estimate effect of dynamic topography

Residual topography will allow testing of geological/structural concepts